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ABSTRACT

In order to examine the emergence of semantic notions and their interaction with the linguistic codes of bilingual children, this paper focuses on acquisition of a semantic field related to Piagetian tasks of conservation. The hypothesis examined in this study states that the manifestation of a concept will occur first in the bilingual's dominant language and only later in the weaker language. Subjects were two groups of Mexican-American children, first graders and sixth graders, bilingual in Spanish and English. In terms of the school setting, the older bilinguals had shifted language dominance from first to second language; the younger group was developmental, but dominant in first language. Using a cross-sectional approach, the study investigated some of the complex interactions between first and second language cognitive development. The view is taken that the manifestation of certain aspects of conceptual development in the bilingual child's two languages does not involve a simple lateral transfer of a particular concept from one language to the other but, rather, that both languages draw from a shared set of linguistic principles and conceptual notions. In addition to a discussion of the theoretical issues, practical implications for assessment and placement of children in bilingual programs are noted. (Author/AMH)

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EMERGENCE OF SEMANTIC NOTIONS IN CHILD BILINGUALISM

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Introduction

Semantic intentions expressed in children's first language may be viewed as the result of an interaction between the development of cognitive structures and the linguistic complexity of the language systems. This is consistent with Piagetian theory on cognitive development and research findings in child language studies. Specifically, for the child to understand the meaning or semantic notions of a linguistic expression, pre-requisites include cognitive structures for processing the non-linguistic content of an expression, knowledge of the symbols and the rules for organizing them into a linguistic expression.

A difficult and complex interaction to analyze for first language acquisition, the relationship between linguistic and cognitive development poses critical questions for an understanding of child bilingualism. Cummins (1976) summarizes relevant studies investigating these relationships and argues that bilingualism represents an enriched form of experience capable of positively influencing intellectual functioning provided that some of the initial difficulties in coping with the two languages are overcome.

In order to examine relationships between the bilingual child's first language (L1) and second language (L2) and their interaction with cognitive

development, this paper focuses on the acquisition of language related to a set of the Piagetian tasks of conservation used to assess stages of cognitive development in children. The hypothesis for this study states that interactions between levels of language and cognitive development affect the bilingual child's performance on Piagetian conservation tasks. For children in the process of acquiring a second language, concepts are performed first in L1 and only later in L2. Performance in L1 can be taken as an indicator of the stage of Piagetian cognitive development of the child. Performance in L2 draws on the interactive effects between the child's two languages and cognitive functioning. Although both languages are viewed as sharing a set of linguistic principles and conceptual notions, the manifestation of a concept in two languages does not involve a simple lateral transfer of a particular concept from one language to the other. Linguistic competence, in other words, influences performance on cognitive tasks.

Piaget's theory of cognitive development, although not explicitly addressing the issue of bilingualism, has implications for an understanding of child bilingualism and its relationship to cognitive functioning. Sinclair (1969) provides evidence concerning the relationship between concrete operational ability as determined through conservation tasks and linguistic form. She found that the best linguistic indicator for conservation is a structure in which attributes are handled simultaneously as in hers is thicker and longer/his is thinner and shorter. Non-conservers use attributes one at a time as in hers is thick and his is thin/hers is long and his is short. Sinclair's studies have

clarified relationships between language and operational thought, emphasizing a high degree of correlation between language used and mode of reasoning. Sinclair additionally demonstrated that language to express relations such as more than is necessary but not sufficient for the cognitive stage of concrete operations. Even after instruction on the terms needed to perform Piagetian tasks, non-conservers did not perform the task successfully. From Piaget's theory comes the notion that the child's early meanings are as much something done as something possessed (Piaget, 1971). Conservation tasks, which require a type of action on an environment and the language used to express that action, consequently, may give insights into the interactive complexities of language development and cognitive functioning for the bilingual child.

In research on the interactive effects of cognitive functioning and bilingualism, Tremaine (1975) found that concrete operational thought and the comprehension of syntax in the bilingual child appear to be based on the same abilities. Her results support an earlier conclusion by Kessler (1971) and Swain (1971) that certain aspects of the two languages of the bilingual child are not encoded separately. One may expect, then, that the emergence of the bilingual's linguistic systems and subsequent developments are interlocked with the set of universal cognitive structures the child brings to the tasks of acquiring the first and second language.

Linguistic semantic theory also provides a perspective for viewing relationships between conception of the physical world and the generalization of conceptual structures from the domain of one language to the wider domain

of a second language. In the acquisition of the semantic system of a language, the child must develop an awareness of the association between certain lexical items and meanings. As Jackendoff (1976) argues, the fact that such associations are acquired leads to the hypothesis that innate principles of organization strongly influence the discovery of concepts and their semantic description in a given language.

In studying the acquisition and expression of the concepts associated with conservation of number, mass, length, area, and continuous quantity, the semantic notions of entity and attribute as they relate to the notion of semantic field give a construct for examining concepts, though distinct, as sharing certain semantic relationships. The critical relationship is that of attribute to entity. The field of entities used in the conservation tasks administered for this study includes the labels string for conservation of length, pennies for number, stuff for mass, grass for area, and water for continuous quantity or volume. Other studies done with child language acquisition and Piagetian tasks have, for example, used other entities as well as different sets of tasks, for example, de Avila and Havassy (1974) in their study of Mexican American children.

To express the entity-attribute relations required for the conservation tasks, it is necessary to specify some attribute of an entity which could not be known from the class characteristics of the entity alone. Attribution, central to the acquisition of the semantic field for conservation concepts, is defined by Leonard (1976:4) as "the recognition of properties not inherently part of the class to which the object belongs." For example, in

The room is chilly, room is the entity and chilly is the attribute. Applied to conservation tasks, an acquisition order for the emergence of semantic notions involving entities of the semantic field of number, mass, length, area and continuous quantity reflects an order for the semantic notions of attribution: sameness or equality and more than.

In addition to entity-attribute relationships, the operation of recurrence is also required for conservation tasks. Recurrence utterances refer to the appearance of another instance of an entity or category of which one instance has already been present. Recurrence is evident in the response same as or equal to in reference to an entity previously observed. The operation of recurrence is also used to comment upon an additional quantity of some entity which has already been present as in more than or longer than. For the child, then, to perform conservation tasks, entity-attribute constructs together with recurrence comments are required while the child conceptually manipulates physically observable variables.

Subjects

Subjects for this study were two groups of Mexican-American children bilingual in Spanish and English. One group comprised of 57 first-graders, ages 6-7, was transitional between Piaget's pre-operational and concrete operational stages. The other group, 50 sixth-graders, ages 11-12, represents the upper end of concrete operational thought and transition into formal operations. Essentially, acquisition of English as the second language began with entry into kindergarten although all of the children had had some

exposure to English prior to that time. The younger group was developmental in L1 and L2, but dominant in L1 as determined by language assessment criteria developed locally by the school districts and the Language Assessment Scale (LAS) test. As a result, all of the first-graders had been placed in bilingual education programs in which a significant portion of instruction was conducted in Spanish. Spanish continued to be the preferred language, however, both at home and at school. The sixth-graders, on the other hand, had participated in transitional bilingual education programs and at the time of testing were in the third year of monolingual English schooling. In terms of the school setting, the older group indicated preference for L2 rather than L1.

In addition to attempting to control for chronological age, level of formal education, type of bilingualism, and language facility, this study also controls for socio-economic status and socio-cultural variables. All subjects lived in the same Mexican-American neighborhood of a low socio-economic area of San Antonio, Texas.

Procedure

Five Piagetian conservation tasks were administered in Spanish and English by the regular classroom teachers specially trained to administer the tasks. For the first-graders, each task was administered orally and individually to each child. To minimize the effect of the stronger language on the weaker, tasks were first administered in L2, English. For the sixth-graders, a group-administered set of tasks, identical to the form of

those used for the younger children, was given. An earlier study by de Avila and Havassy (1974) demonstrated the reliability of this approach. The same order of language presentation was observed with the older group as was observed with the first graders. An interval of several days was maintained between the administration of the tasks in Spanish and English. The specific procedure for administering the tasks was a pilot adaptation of standardized versions of the tasks, taking into account Spanish-language variations common to the population tested. (For test script, see Appendix.)

Results

For the first-graders results from 570 separate tasks, 10 per child, were tabulated. Table 1 summarizes the results of the Piagetian conservation measures for both languages. The order of conservation tasks is determined by the percentage of bilingual children able to perform successfully each of the five tasks.

TABLE 1

PERCENTAGE OF BILINGUAL CHILDREN ABLE TO
PERFORM PIAGETIAN CONSERVATION TASKS
FIRST-GRADERS, AGES 6-7

N = 57	Spanish	English
Number	68	28
Mass	16	14
Volume (Continuous Quantity)	11	5
Area	5	2
Length	2	2

Of the 57 bilinguals in the sample, 16 or 28 percent were non-conservers on all tasks in both languages. This is consistent with Piagetian theory which identifies children at this age-level as generally preoperational or transitional. For children ages 2 to 7 years judgments of quantity are generally based on attention to only one property at a time. Children at the preoperational stage of cognitive development are unable to attend to the interaction of two properties at the same time, a cognitive process necessary in conservation tasks. In a typical task during which the child is given two glasses of water, for example, one tall and one short, containing equal quantities of water, the pre-operational child generally judges that the tall glass contains more water than the short glass since the perception of quantity is one-dimensional in terms of height or width of the glass but not both dimensions at the same time.

Of the remaining 41 children in the sample, all except 2 conserved number in Spanish, the dominant language. Of these children, only 16 or 28 percent conserved number in English, their second language. Nine children conserved mass in Spanish; eight in English. Six children conserved volume in Spanish and of these, three also in English. Three conserved area in Spanish and one in English. One child conserved length in both languages.

The pattern emerges, then, that the Spanish-dominant first-grade bilingual children manifested conservation first in Spanish and only later in the second language. The entity-attribute relationships required for conservation of number emerge first in both languages, mass came second. Semantic notions involving conservation of volume, length and area remain largely undifferentiated for the younger group.

For the sixth-graders, results from 500 separate task tests are summarized in Table 2.

TABLE 2
PERCENTAGE OF BILINGUAL CHILDREN ABLE TO
PERFORM PIAGETIAN CONSERVATION TASKS
SIXTH-GRADERS, AGES 11-12

N = 50	Spanish	English
Number	100	94
Length	92	82
Volume (Continuous Quantity)	90	82
Mass	88	82
Area	72	62

Of the older group, all conserved number in Spanish; three, however, did not conserve in English. Mass, length and continuous quantity indicate clustering. For English, performance indicates these three concepts are undifferentiated and only marginally so in Spanish. Of the semantic field investigated, the last notion to develop is that of the entity-attribute relationship for area, a finding consistent with Piaget's research. Results from the sixth-graders are the same as for the first-graders in that conservation was manifested in the child's first language, Spanish, and only later in the second language, English.

The difference in ordering between first and sixth-graders is most probably attributed to differences in experiences as they progressed through grade levels. Over the instructional periods intervening between grades one and six, children experience many tasks focusing on length measurements, which may account for the change in ordering for conservation of length. Studies with monolingual children (Piaget and Inhelder, 1969) consistently give conservation of number as the first acquisition, followed by mass and later by area.

Discussion

Piagetian conservation tasks deal with a semantic field involving both discrete items in a quantitative measure and non-discrete quantities. Of the five entities examined, only number requires the ability to take account of discrete or countable items in a quantitative measure. Semantic notions involving the conservation of mass, length, volume and area all

require the ability to assign the attributes of more than or same as in English, más que, igual or la misma cantidad in Spanish to the recurrence of a previously presented conceptual situation.

Evidence that bilingual children appear to conserve number in both languages before they conserve other entities suggests that semantically there is a critical distinction between discrete entities, such as pennies, and other members of the semantic field. For young bilingual children transitional between pre-operational and operational thought, the assignment of attributes of more than or same as remains largely undifferentiated for non-discrete materials. As development progresses, however, those children who conserve a concept in L2, also, by implication, conserve that same concept in L1.

The language performance pattern observed for the younger children moving into operational thought can also be observed for the group transitional between that stage and formal thought. Even though the sixth-grade children had been educated in the second language, English, for at least three years of their elementary school curriculum, semantic notions associated with Piagetian conservation tasks continued to be performed first in Spanish and only later in the second language, English. This may suggest that the older children continue to be dominant in L1 even though the first language, Spanish, has been replaced by L2, English, as the language of instruction in the school setting.

For both groups, attribution of more than and same as associated with

an entity of visibly discrete particles appears to be an earlier acquisition than with materials consisting of non-discrete particles. In addition, it appears that the attributes associated with the commonly experienced entity of length develop before the attributes associated with less common entities.

In the design of this study, using first and sixth graders, not only can it be observed that extensive cognitive and linguistic development has occurred over time but also that a degree of re-ordering for the emergence of certain semantic notions has taken place. One may hypothesize that this re-ordering reflects language and cognitive experiences during the early school years. Learning to take linear measurements, for example, may account for the higher acquisition order for length observed for the older children.

Conclusions and Implications

In summary, the theoretical position taken here for studying the emergence of a set of semantic notions is viewed as most clearly characterized by types of actions carried out in context, specifically the context of the conservation tasks. Acquisition of semantic entity-attribute relationships, observed through performance on conservations tasks, are taken as indices of underlying linguistic competence and cognitive development. The time lag between performance of concepts in L1 and L2 appears to be relatively minimal, suggesting that the two languages draw from a common core of semantic notions and relationships. In tapping underlying abilities which define concrete operational intelligence and aspects of the semantic system of language, the bilingual child is not engaged in a simple process of transferring a concept laterally from L1 to L2 but rather relies on cognitive-language interactions which are realized on the surface first in the dominant language. Clearly,

this is not to imply that a concept is not available to the second language. On the contrary, once a child is at a certain level of cognitive development, the concept is present, available to the linguistic competence governing both languages.

Data from this study indicate that conceptual performance as determined through Piagetian tasks occurs first in the primary, dominant language and later in the second language. The comparisons made here do not lend themselves to the common statistical tests of significance. Further research would be needed to determine if the slight delay in language performance is statistically significant in all cases. Of importance, however, is the non-simultaneity in the L1 and L2 performance of underlying concepts.

Apart from the theoretical issues involving the complex interactions between cognitive functioning and the bilingual's two linguistic systems, a practical implication for teachers and administrators concerned with bilingual education programs is that assessments of the bilingual child's levels of cognitive and language development conducted in the second language may, in fact, lead to erroneous interpretations, classifying bilingual children at levels below those at which they actually are when they are tested in L1. If bilingual children give evidence of concept development in the first language and only later in the second language, as this study indicates, assessments of children's performance, formal or informal, in L2 can be misleading, giving an interpretation that the bilingual child has not yet reached a particular level of conceptual development. Implications are clearly apparent for any comparison of results from children tested in L1 with those of bilingual children tested in L2. Findings of this study imply that under

such conditions the bilingual child may appear disadvantaged, depending on the language development relationships between L1 and L2.

Piaget's theory of cognitive development and the tasks used to investigate aspects of that development suggest a fruitful approach to gaining insights into the complex interactions of the bilingual child's language systems, and levels of cognitive functioning. These insights might productively be applied to the construction of more accurate assessment instruments for determining the conceptual development of bilingual children.

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APPENDIX

Piagetian Task Script

Mass: I am holding two balls.
 Do you think they have about the same amount of stuff in them?
 How about this? Now do they have about the same?
 Let's do this with this one.
 Now do they both have the same amount of stuff in them or does one have more?
 Now does one have more or do they have the same amount?
 How come?
 Thank you.

Length: Here are two strings. See.
 Are they the same length or just as long as each other?
 Now is one longer or are they still the same?
 Why?
 Yes, thank you.

Number: Which row has more pennies in it or are there the same number of pennies in each row?
 Why?
 Good! Thank you.

Volume: Let's try another puzzle. You are doing very well.
 I am going to put the water from this glass into this other one.
 Which glass holds more water or do they both hold the same?
 How come?
 Yes. That's fine.

Area: One more.
 Let's pretend this is a lot of grass for cows to eat.
 These are the cows. Here are some on this ranch. And here are some on this one.
 Which cows have more to eat or do they have the same?
 How come?
 Thank you for helping us. You did fine.

Papel de los participantes
en una tarea de Piaget

Masa: Aquí tengo dos pelotas.
¿Crees que tienen más o menos la misma cantidad de material dentro ellas?
Ahora si hago esto, ¿Crees que siguen iguales por dentro? Vamos a hacer esto con ésta.
Ahora, ¿tienen la misma cantidad de cosas dentro, o tiene una más que la otra?
Ahora, ¿tiene una mas que la otra, o son iguales?
¿Por qué?
Gracias.

Largura: Aquí hay dos cordones. Ves.
¿Son iguales de largo - es uno tan largo como el otro?
¿Ahora está más largo uno de ellos, o siguen iguales?
¿Por qué?
Sí, gracias.

Numero: ¿Cuál de estas filas contiene más centavitos? O son iguales?
¿Por qué?
¡Muy bien! Gracias.

Volumen: Vamos a ver otro problema. Los estás haciendo muy bien.
Voy a poner el agua de este vaso en este otro.
¿En cuál vaso puede caber más agua?
¿O se puede poner la misma cantidad en uno como en otro?
¿Por qué es así?
Sí. ¡Que bueno!

Area: Un problema más.
Vamos diciendo que esto es mucho zacate para que lo coman las vacas. Estas son las vacas. Aquí estan algunas en este rancho. Y aquí están otras en este otro rancho.
¿Cuáles vacas tienen más que comer, o son iguales?
¿Por qué?
Gracias por tu ayuda. Hiciste muy bien.

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